# Freight Rail Emission Reduction Strategy To Help Meet 2014 Air Quality Standards for PM2.5

## Preliminary Proposal

SCAG Goods Movement Control Strategies Workshop - August 2, 2007

# Air Quality Challenge

# Background

## 1. Federal Clean Air Act Requirements

- 8-Hour Ozone and PM2.5 SIPs

## 2. 2007 South Coast AQMP

- Responsible agencies:
  SCAQMD, ARB, SCAG
- SCAG's responsibilities include development of transportation programs, measures, and strategies

# Challenges

## PM2.5

**Annual Standard**

2014 Attainment Date
50 t/day NOx shortfall
No black box allowed

**New 24-hour Standard**

2012 SIP Submittal (Est.)
2019 Attainment Date (Est.)
Further Reductions Req.

## 8-Hour Ozone

**8-Hour Ozone**

2023 Attainment Date
180 t/day NOx black box

**Standard Under Review**

Possible Tightening

# Control Measures Chronology

**Draft AQMP**

Includes extensive goods movement issues discussion, including need for comprehensive control strategy and innovative technologies

**Modifications to Draft AQMP**

Conceptual description of control measures (High-Speed Rail and Truck-Only Lanes)

**FEB.** **OCT.**

**2006**

# Control Measures Chronology

**Addendum to Modifications**

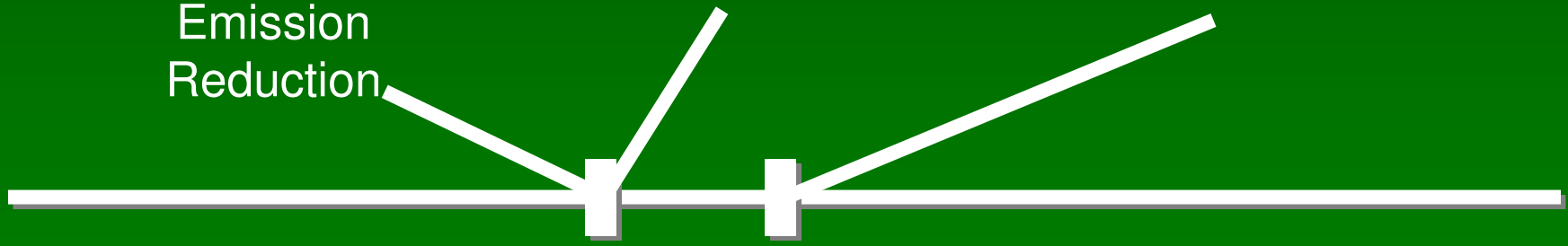
Measures Refined

Estimated Emission Reduction

**RC Approval of SCAG's Portion of AQMP and Declaration of Air Quality Crisis**

**SCAQMD Approves AQMP**

**Delays Action on SCAG Measures**



**MAY JUNE**

**2007**

# Control Measures Chronology

**SCAQMD Approves Transportation Emission Budgets Without SCAG Measures**

**ARB to Consider State SIP Strategy and South Coast AQMP**

**JULY** **SEPT.**

**2007**

# Next Steps

- Continued Analytical Work/Refinement of Strategies (Ongoing)
- ARB to Consider State Strategy and South Coast AQMP (Sept. '07)
- Vetting of Strategies Through RTP Update Process (Draft RTP Oct./Nov. '07)
  - Broad transportation system strategies to achieve short- and long-term emission reductions and system capabilities and efficiencies
- Consideration of SIP Amendment to Incorporate Approved Strategies

# Investment Strategy

# Investment Package Strategic Principles

1. Combine related rail investments into one package
2. Package must include mobility and air quality projects
3. All stakeholder groups must benefit from and contribute to the investment package
4. Other needed rail investments will be addressed separately

# Two Investment Package Options

## Package #1

Rail Expansion

+

Grade Separations

+

Electrification

## Package #2

Rail Expansion

+

Grade Separations

+

Engine Upgrades

**Rail Expansion And Grade Separations Have Been Part Of Your SCAG RTP Since 2000**

# Package #1 Cost in Billions

| Package #1 | In 2007 dollars |
| --- | --- |
| Rail Expansion | $ 2.29 |
| + | |
| Grade Separations | $ 4.60 |
| + | |
| Electrification | $ 6.43* (3 phases) |

**$ 13.32 Billion**

Note: *Preliminary capital cost estimates (escalating 1992 study results to current dollars)
Operating costs not included.

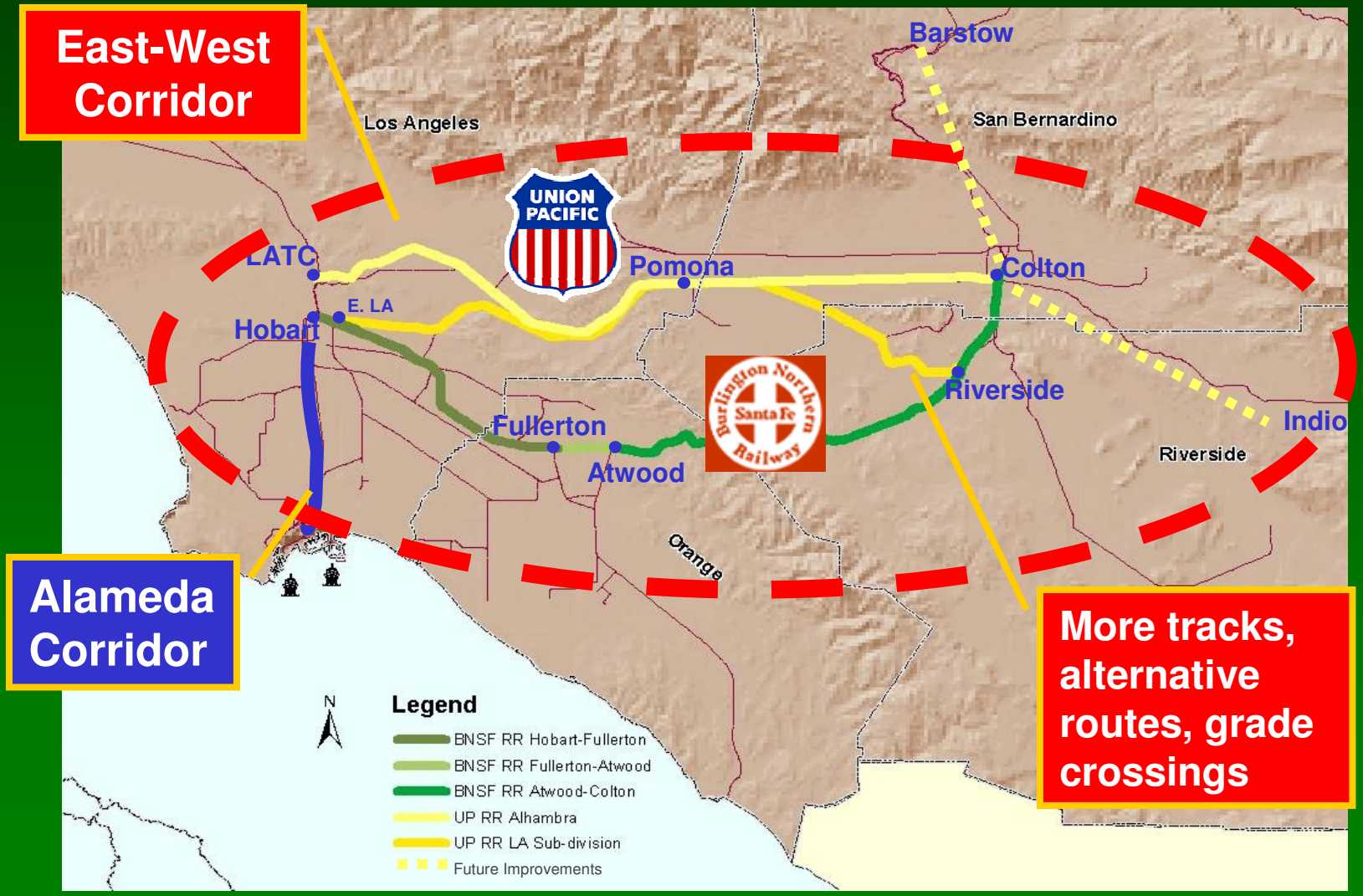
# Package #2 Cost in Billions

| Package #2 | In 2007 dollars |
| --- | --- |
| Rail Expansion | $ 2.29 |
| + | |
| Grade Separations | $ 4.60 |
| + | |
| Engine Upgrades | $ 2.05 |

**$ 8.94 Billion**

# Expansion and Grade Separations

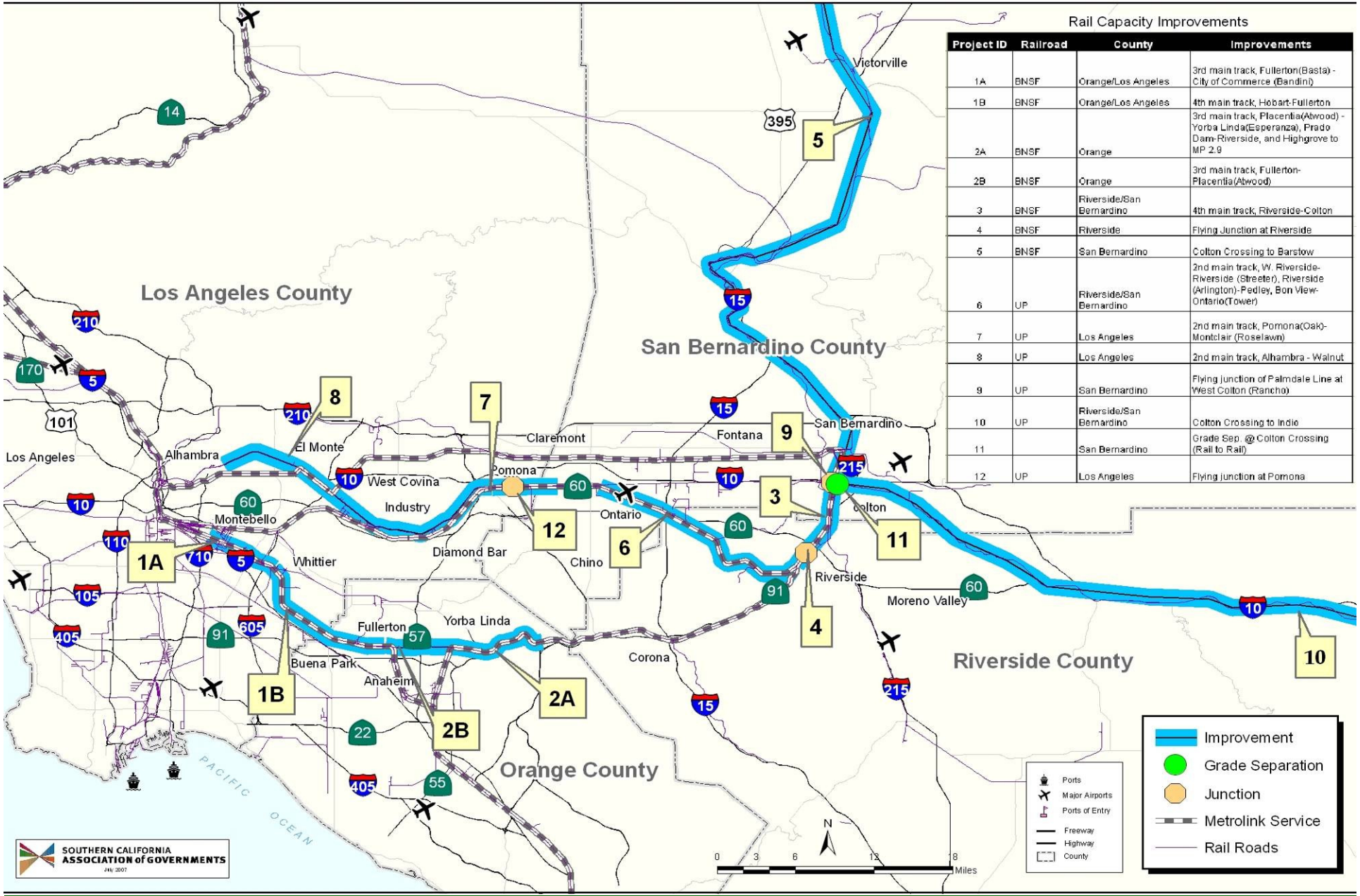
# Rail Expansion & Improvements



# Rail Expansion Investments

- Total cost $2.3 billion
- Expansion is needed for efficiency, expected growth, and Metrolink
- Expansion projects are best implemented after related grade separation projects are completed

# Rail Capacity Improvements Program



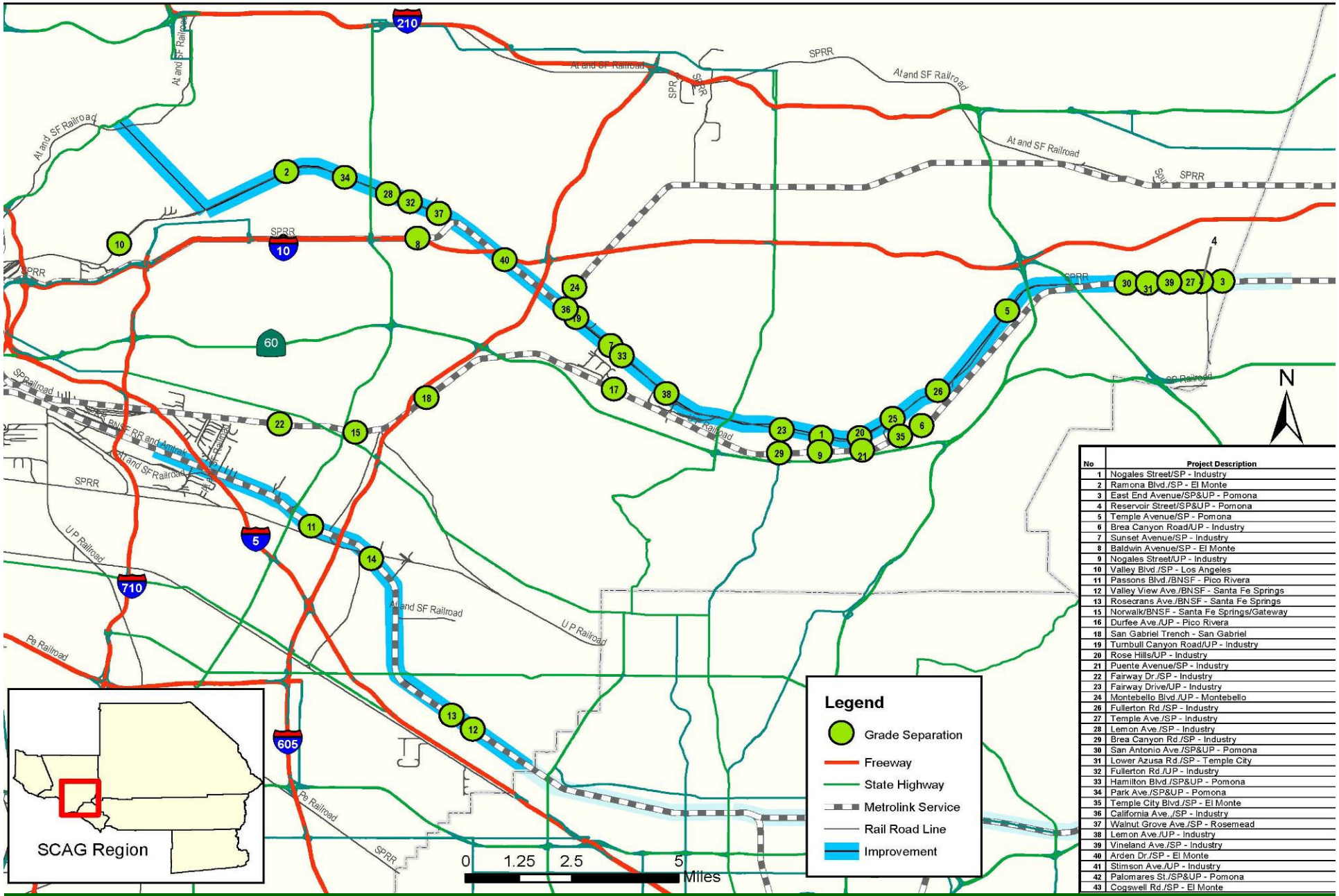

Rail Capacity Improvements

| Project ID | Railroad | County | Improvements |
|---|---|---|---|
| 1A | BNSF | Orange/Los Angeles | 3rd main track, Fullerton(Basta) - City of Commerce (Bandini) |
| 1B | BNSF | Orange/Los Angeles | 4th main track, Hobart-Fullerton |
| 2A | BNSF | Orange | 3rd main track, Placentia(Atwood) - Yorba Linda(Esperanza), Prado Dam-Riverside, and Highgrove to MP 2.9 |
| 2B | BNSF | Orange | 3rd main track, Fullerton-Placentia(Atwood) |
| 3 | BNSF | Riverside/San Bernardino | 4th main track, Riverside-Colton |
| 4 | BNSF | Riverside | Flying Junction at Riverside |
| 5 | BNSF | San Bernardino | Colton Crossing to Barstow |
| 6 | UP | Riverside/San Bernardino | 2nd main track, W. Riverside-Riverside (Streeter), Riverside (Arlington)-Pedley, Bon View-Ontario(Tower) |
| 7 | UP | Los Angeles | 2nd main track, Pomona(Oak)-Montclair (Roselawn) |
| 8 | UP | Los Angeles | 2nd main track, Alhambra - Walnut |
| 9 | UP | San Bernardino | Flying junction of Palmdale Line at West Colton (Rancho) |
| 10 | UP | Riverside/San Bernardino | Colton Crossing to Indio |
| 11 | | San Bernardino | Grade Sep. @Colton Crossing (Rail to Rail) |
| 12 | UP | Los Angeles | Flying junction at Pomona |

# Grade Separation Investments

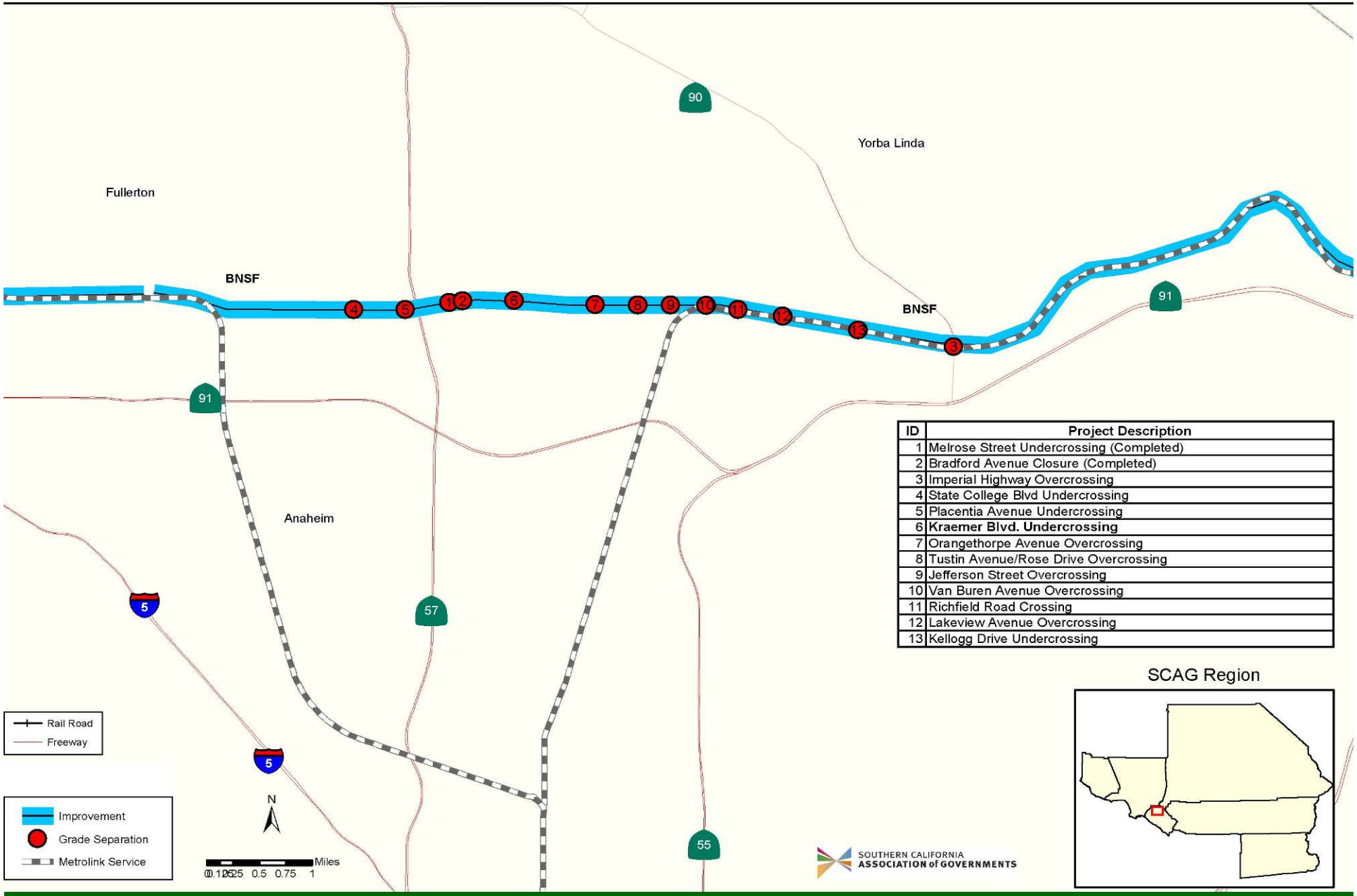
- Total cost $4.6 billion
- Projects consistent with CTC submittals and the Multi-County Goods Movement Action Plan
- Almost $800 million already committed locally

# Grade Separation Projects in Los Angeles County




| No | Project Description |
|---|---|
| 1 | Nogales Street/SP - Industry |
| 2 | Ramona Blvd./SP - El Monte |
| 3 | East End Avenue/SP&UP - Pomona |
| 4 | Reservoir Street/SP&UP - Pomona |
| 5 | Temple Avenue/SP - Pomona |
| 6 | Brea Canyon Road/UP - Industry |
| 7 | Sunset Avenue/SP - Industry |
| 8 | Baldwin Avenue/SP - El Monte |
| 9 | Nogales Street/UP - Industry |
| 10 | Valley Blvd./SP - Los Angeles |
| 11 | Passons Blvd./BNSF - Pico Rivera |
| 12 | Valley View Ave./BNSF - Santa Fe Springs |
| 13 | Rosecrans Ave./BNSF - Santa Fe Springs |
| 15 | Norwalk/BNSF - Santa Fe Springs/Gateway |
| 16 | Durfee Ave./UP - Pico Rivera |
| 18 | San Gabriel Trench - San Gabriel |
| 19 | Turnbull Canyon Road/UP - Industry |
| 20 | Rose Hills/UP - Industry |
| 21 | Puente Avenue/SP - Industry |
| 22 | Fairway Dr./SP - Industry |
| 23 | Fairway Drive/UP - Industry |
| 24 | Montebello Blvd./UP - Montebello |
| 26 | Fullerton Rd./SP - Industry |
| 27 | Temple Ave./SP - Industry |
| 28 | Lemon Ave./SP - Industry |
| 29 | Brea Canyon Rd./SP - Industry |
| 30 | San Antonio Ave./SP&UP - Pomona |
| 31 | Lower Azusa Rd./SP - Temple City |
| 32 | Fullerton Rd./UP - Industry |
| 33 | Hamilton Blvd./SP&UP - Pomona |
| 34 | Park Ave./SP&UP - Pomona |
| 35 | Temple City Blvd./SP - El Monte |
| 36 | California Ave../SP - Industry |
| 37 | Walnut Grove Ave./SP - Rosemead |
| 38 | Lemon Ave./UP - Industry |
| 39 | Vineland Ave./SP - Industry |
| 40 | Arden Dr./SP - El Monte |
| 41 | Stimson Ave./UP - Industry |
| 42 | Palomares St./SP&UP - Pomona |
| 43 | Cogswell Rd./SP - El Monte |

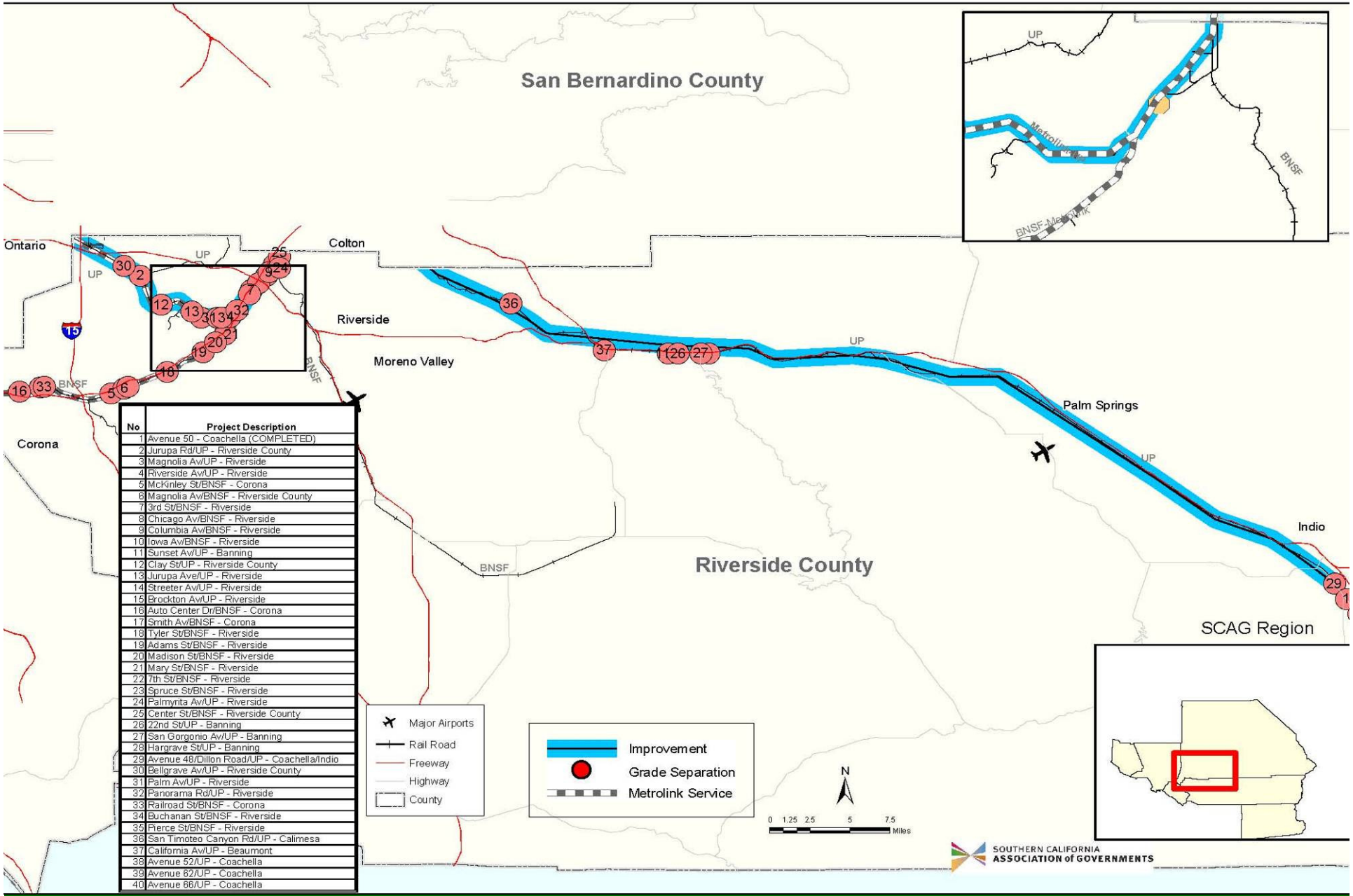
# Grade Separation Projects in Orange County




| ID | Project Description |
|---|---|
| 1 | Melrose Street Undercrossing (Completed) |
| 2 | Bradford Avenue Closure (Completed) |
| 3 | Imperial Highway Overcrossing |
| 4 | State College Blvd Undercrossing |
| 5 | Placentia Avenue Undercrossing |
| 6 | **Kraemer Blvd. Undercrossing** |
| 7 | Orangethorpe Avenue Overcrossing |
| 8 | Tustin Avenue/Rose Drive Overcrossing |
| 9 | Jefferson Street Overcrossing |
| 10 | Van Buren Avenue Overcrossing |
| 11 | Richfield Road Crossing |
| 12 | Lakeview Avenue Overcrossing |
| 13 | Kellogg Drive Undercrossing |

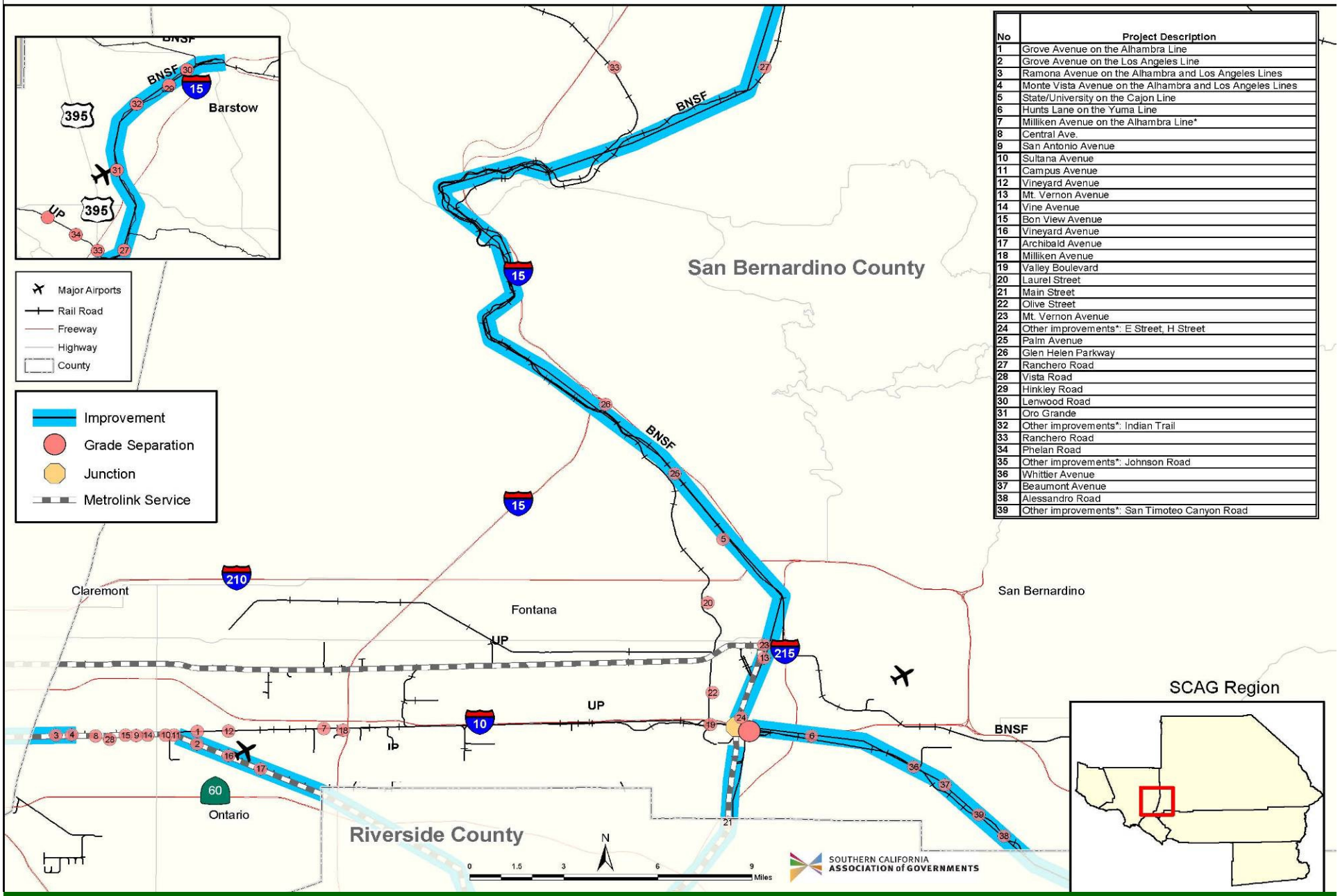
SCAG Region

# Grade Separation Projects in Riverside County




| No | Project Description |
|---|---|
| 1 | Avenue 50 - Coachella (COMPLETED) |
| 2 | Jurupa Rd/UP - Riverside County |
| 3 | Magnolia Av/UP - Riverside |
| 4 | Riverside Av/UP - Riverside |
| 5 | McKinley St/BNSF - Corona |
| 6 | Magnolia Av/BNSF - Riverside County |
| 7 | 3rd St/BNSF - Riverside |
| 8 | Chicago Av/BNSF - Riverside |
| 9 | Columbia Av/BNSF - Riverside |
| 10 | Iowa Av/BNSF - Riverside |
| 11 | Sunset Av/UP - Banning |
| 12 | Clay St/UP - Riverside County |
| 13 | Jurupa Ave/UP - Riverside |
| 14 | Streeter Av/UP - Riverside |
| 15 | Brockton Av/UP - Riverside |
| 16 | Auto Center Dr/BNSF - Corona |
| 17 | Smith Av/BNSF - Corona |
| 18 | Tyler St/BNSF - Riverside |
| 19 | Adams St/BNSF - Riverside |
| 20 | Madison St/BNSF - Riverside |
| 21 | Mary St/BNSF - Riverside |
| 22 | 7th St/BNSF - Riverside |
| 23 | Spruce St/BNSF - Riverside |
| 24 | Palmyrita Av/UP - Riverside |
| 25 | Center St/BNSF - Riverside County |
| 26 | 22nd St/UP - Banning |
| 27 | San Gorgonio Av/UP - Banning |
| 28 | Hargrave St/UP - Banning |
| 29 | Avenue 48/Dillon Road/UP - Coachella/Indio |
| 30 | Bellgrave Av/UP - Riverside County |
| 31 | Palm Av/UP - Riverside |
| 32 | Panorama Rd/UP - Riverside |
| 33 | Railroad St/BNSF - Corona |
| 34 | Buchanan St/BNSF - Riverside |
| 35 | Pierce St/BNSF - Riverside |
| 36 | San Timoteo Canyon Rd/UP - Calimesa |
| 37 | California Av/UP - Beaumont |
| 38 | Avenue 52/UP - Coachella |
| 39 | Avenue 62/UP - Coachella |
| 40 | Avenue 66/UP - Coachella |

# Grade Separation Projects in San Bernardino County




| No | Project Description |
|---|---|
| 1 | Grove Avenue on the Alhambra Line |
| 2 | Grove Avenue on the Los Angeles Line |
| 3 | Ramona Avenue on the Alhambra and Los Angeles Lines |
| 4 | Monte Vista Avenue on the Alhambra and Los Angeles Lines |
| 5 | State/University on the Cajon Line |
| 6 | Hunts Lane on the Yuma Line |
| 7 | Milliken Avenue on the Alhambra Line* |
| 8 | Central Ave. |
| 9 | San Antonio Avenue |
| 10 | Sultana Avenue |
| 11 | Campus Avenue |
| 12 | Vineyard Avenue |
| 13 | Mt. Vernon Avenue |
| 14 | Vine Avenue |
| 15 | Bon View Avenue |
| 16 | Vineyard Avenue |
| 17 | Archibald Avenue |
| 18 | Milliken Avenue |
| 19 | Valley Boulevard |
| 20 | Laurel Street |
| 21 | Main Street |
| 22 | Olive Street |
| 23 | Mt. Vernon Avenue |
| 24 | Other improvements*: E Street, H Street |
| 25 | Palm Avenue |
| 26 | Glen Helen Parkway |
| 27 | Ranchero Road |
| 28 | Vista Road |
| 29 | Hinkley Road |
| 30 | Lenwood Road |
| 31 | Oro Grande |
| 32 | Other improvements*: Indian Trail |
| 33 | Ranchero Road |
| 34 | Phelan Road |
| 35 | Other improvements*: Johnson Road |
| 36 | Whittier Avenue |
| 37 | Beaumont Avenue |
| 38 | Alessandro Road |
| 39 | Other improvements*: San Timoteo Canyon Road |


I 10
W K St
W L St
S 6TH St
W M St
N
W
E
© 2007 Europa Technologies
© 2005 Google

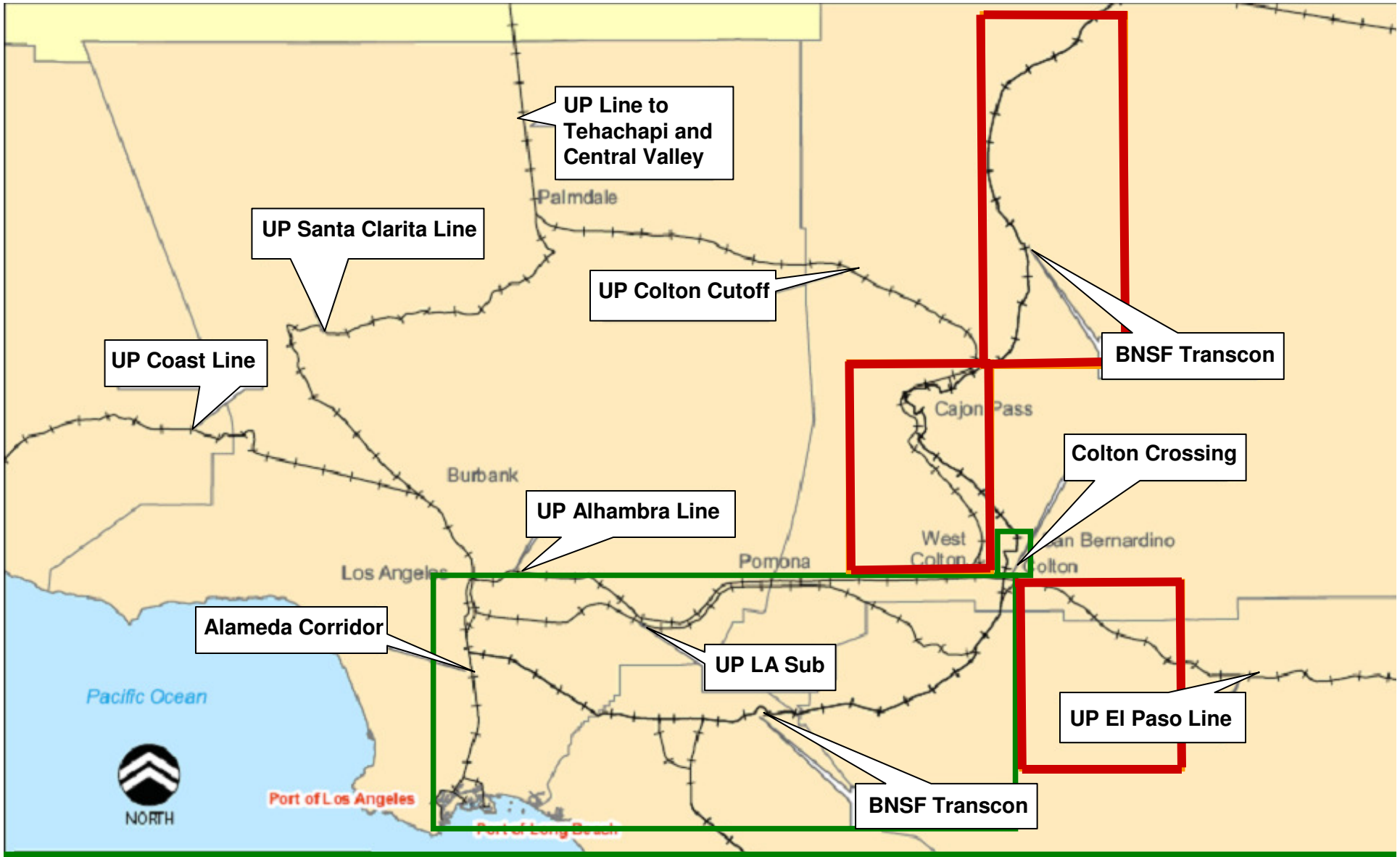
# Rail Electrification

# Rail Electrification

- Phased Approach in Priority Order
- Scenarios do not completely cover the rail infrastructure in the region
- Requires holding areas to switch engines

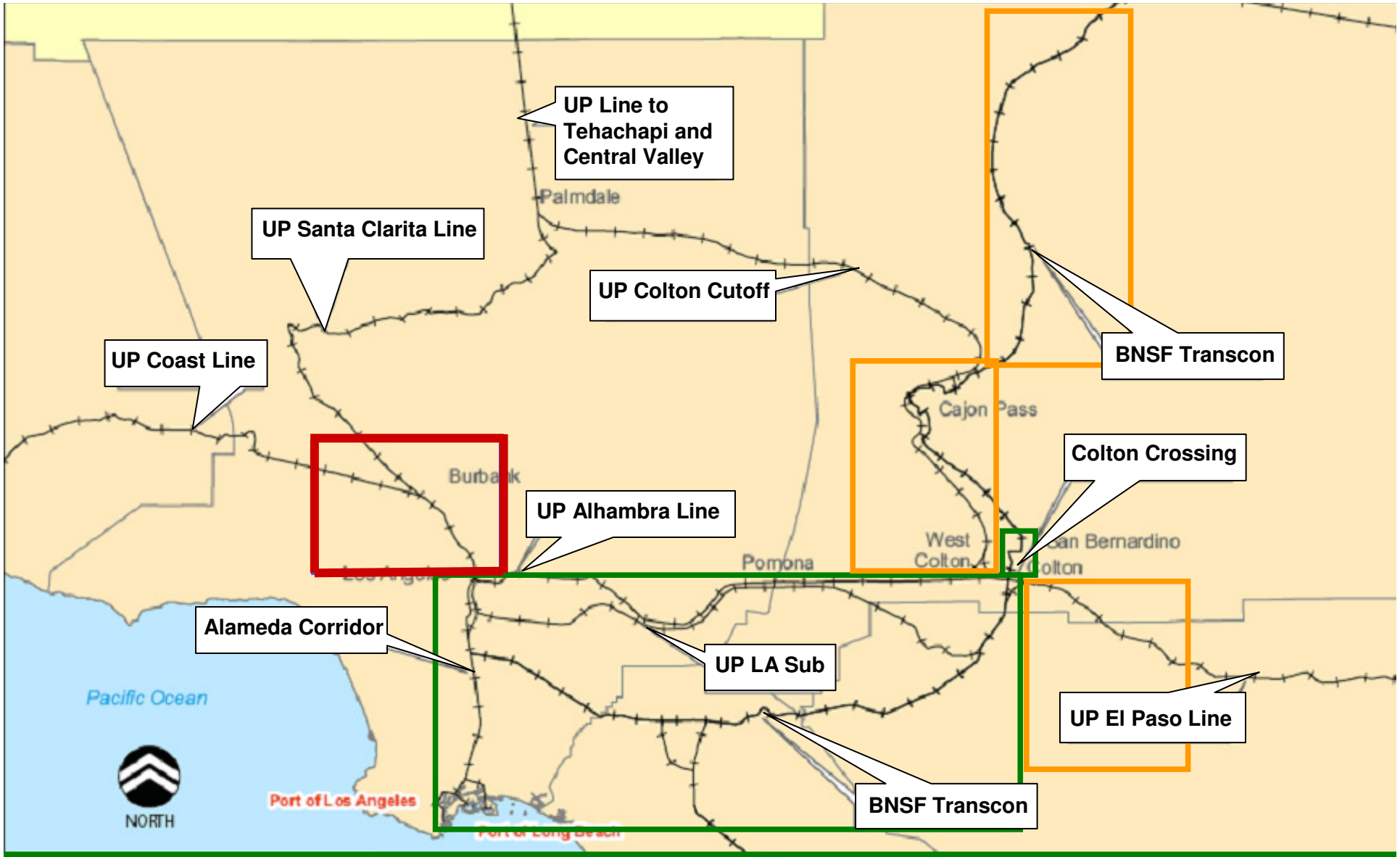

**#1** Primary East/West Freight Line Electrification

| Miles | Locomotives | Cost |
|---|---|---|
| 250 | 360 | $3.4B |




# #2 Electrification Extension to Barstow and Indio

| Miles | Locomotives | Cost |
|---|---|---|
| 170 | 360 | $2.5B |




# #3

Electrification Extension to Chatsworth and San Fernando

| Miles | Locomotives | Cost |
|---|---|---|
| 40 | 55 | $0.53B |

# Engine Upgrade

# Proposed EPA Emissions Standards

| Tier | Phase In |
| --- | --- |
| Tier 3 | 2009 |
| Tier 4 | 2014 |

# Potential Acceleration Strategies

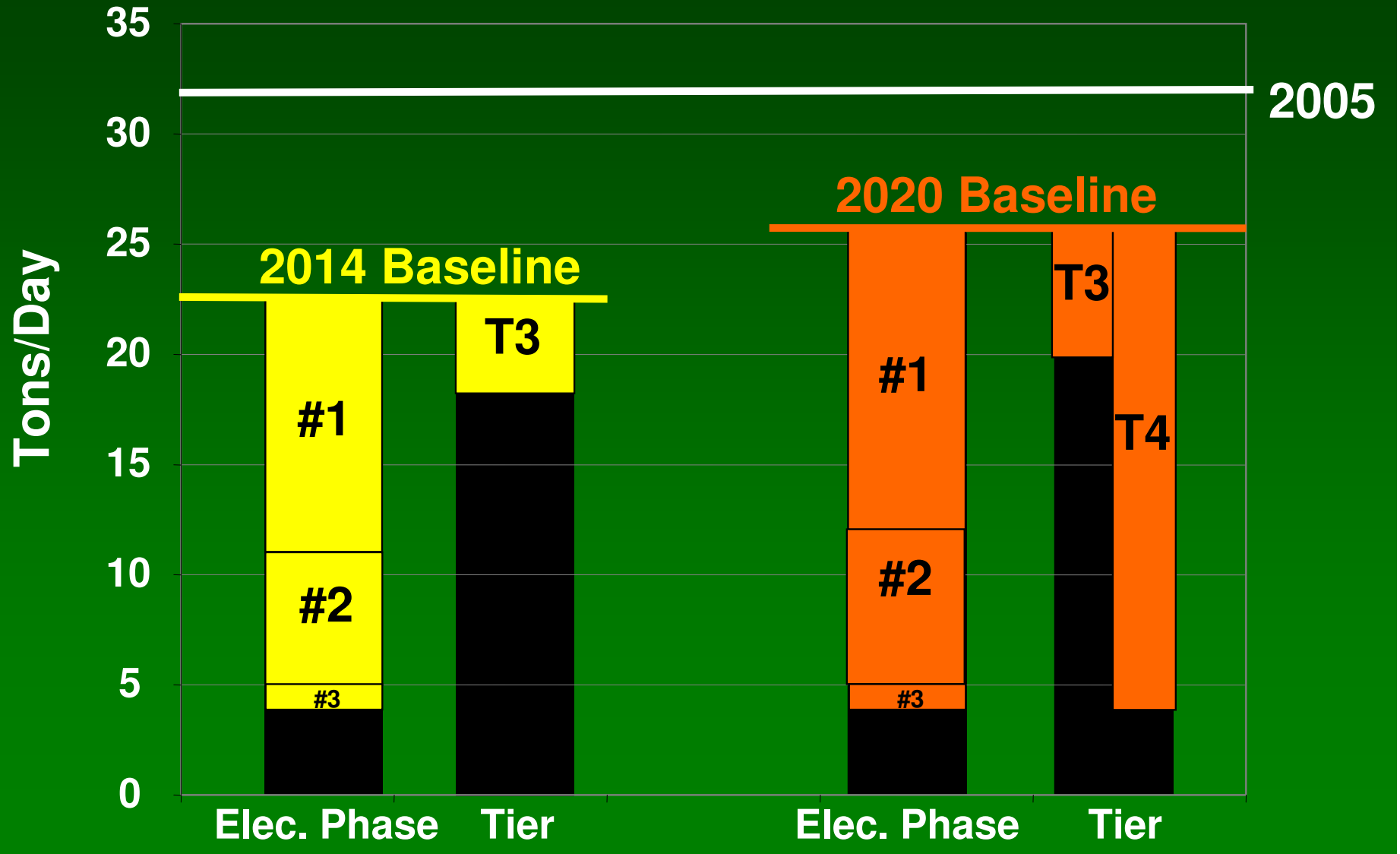
| Upgrade to Tier 3 | Upgrade to Tier 4 |
| --- | --- |
| Start by 2009 and complete by 2014 | Start by 2014 and complete by 2020 |

**Incentives are needed to accelerate upgrades**

# Scenario Comparisons

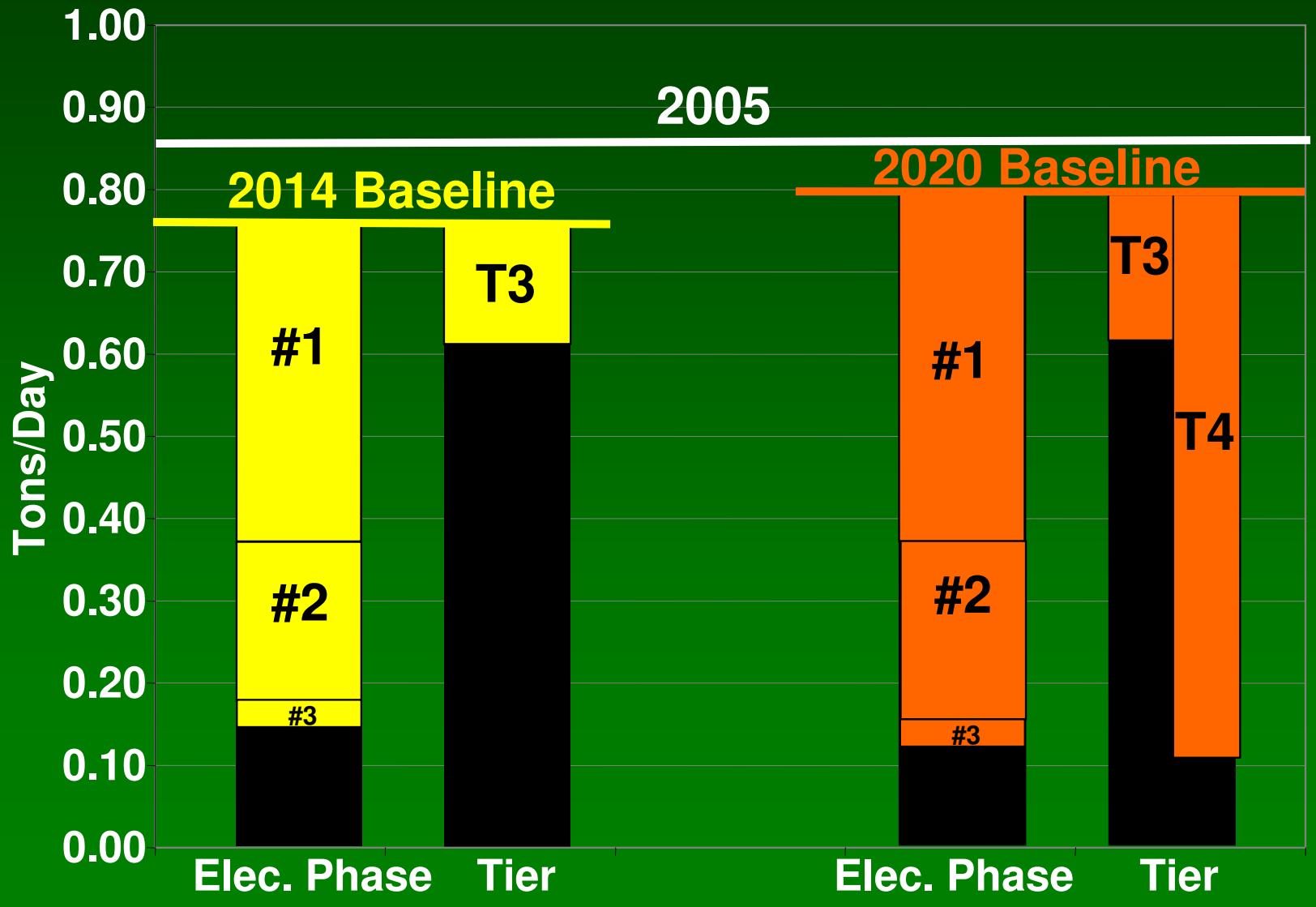
# NOx Emission Reduction Estimates

(all scenarios include grade separations and rail expansion)

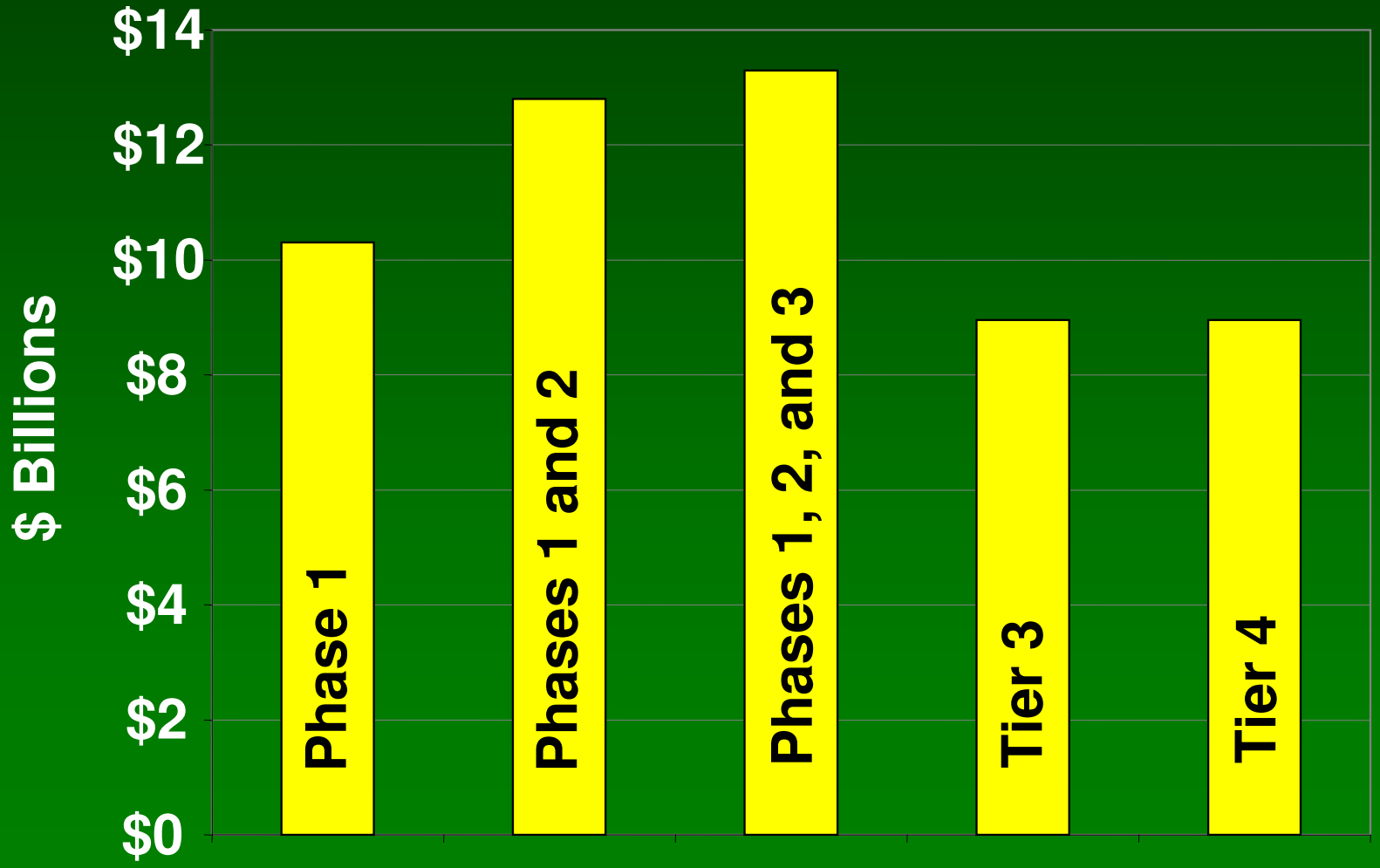


# PM 2.5 Emission Reduction Estimates

(all scenarios include grade separations and rail expansion)



# Scenario Cost Comparisons
## (in constant $2007)



# Cost Effectiveness

| | | ($/ton) NOx | ($/ton) Direct PM2.5 |
|---|---|---|---|
| 2014 | Electrification (Phase 1) | $44,859 | $1,301,887 |
| | Electrification (Phase 1,& 2) | $52,115 | $1,512,267 |
| | Electrification (Phase 1, 2, & 3) | $55,057 | $1,598,410 |
| | Engine Upgrade to Tier 3 | $133,426 | $884,383 |
| | Engine Upgrade to Tier 4 | -- | -- |

| | | ($/ton) NOx | ($/ton) Direct PM2.5 |
|---|---|---|---|
| 2020 | Electrification (Phase 1) | $37,952 | $1,215,689 |
| | Electrification (Phase 1,& 2) | $44,359 | $1,421,531 |
| | Electrification (Phase 1, 2, & 3) | $47,012 | $1,505,229 |
| | Engine Upgrade to Tier 3 | $117,579 | $831,655 |
| | Engine Upgrade to Tier 4 | $11,980 | $361,439 |

**The Tier 4 option is likely more attractive to the railroads, especially if the region can offer a financial incentive to accelerate deployment.**

# Electrification

- **Advantages**
  - Technology exists and has been deployed before
  - Possible implementation by 2014
  - Helps meet attainment goals in 2014 and beyond

- **Disadvantages/Risks**
  - Expense (over $6 billion), could be higher given recent cost escalations
  - Disruptive to railroad operations, likely opposition
  - Unlikely to gain partial funding from railroads
  - Implementation by 2014 very challenging (funding, institutional, railroads, construction, right-of-way)

# Engine Upgrades

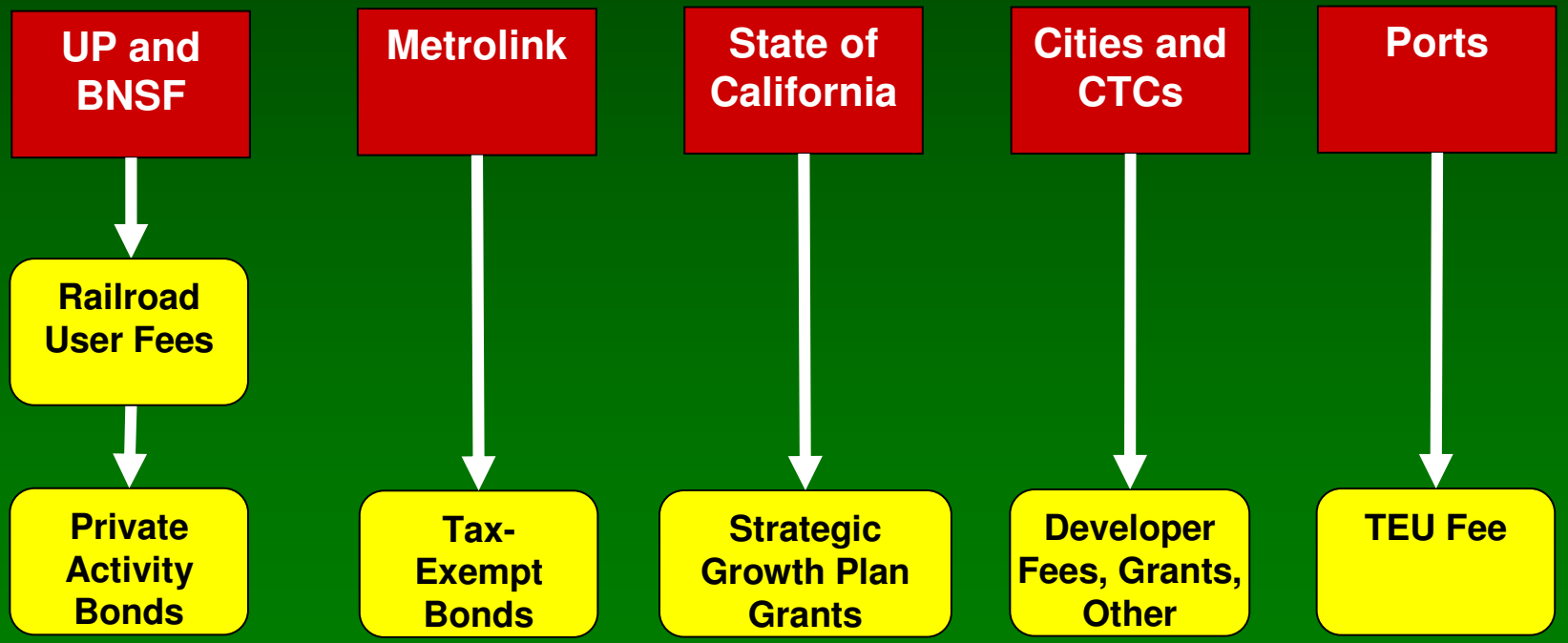
- **Advantages**
  - Cost is lower than electrification ($2 billion vs. $6 billion)
  - Railroads will eventually upgrade locomotives, likely to accelerate upgrades with proper incentives
  - Potential for partial funding by railroads
  - NOx and PM reductions by 2020 similar to electrification
- **Disadvantages/Risks**
  - Tier 4 Technology does not exist yet for 2014 implementation
  - Does not help the region meet the 2014 attainment goals (assuming that Tier 4 production cannot be significantly accelerated)

# Possible Funding Framework

# Benefits by Stakeholder Group

- **Railroads** – lower expansion costs (due to lower cost of borrowing, contributions from other stakeholders), corporate citizenship
- **Metrolink** – increased capacity to continue and expand service
- **Cities and CTCs** – mobility and safety benefits from grade separations
- **Ports** – facilitating aggressive on-dock expansion
- **State** – contribution to State leadership in goods movement
- **ALL** – REDUCED AIR POLLUTION AND IMPROVED MOBILITY

# Proposed PPP Cost Allocation



# Uses of Funds

In Billions

| | Phase1 | 1 & 2 | 1, 2 & 3 | Tier 3 | Tier 4 |
|---|---|---|---|---|---|
| Rail Capacity | 2,971 | 2,971 | 2,971 | 2,971 | 2,971 |
| Grade Separation | 5,996 | 5,996 | 5,996 | 5,996 | 5,996 |
| Electrification | 4,113 | 7,195 | 7,846 | | |
| Engine Upgrade | | | | 2,430 | 2,490 |
| Bond Issuance | 221 | 307 | 323 | 179 | 181 |
| **Total** | **13,300** | **16,469** | **17,136** | **11,576** | **11,638** |

# Sources of Funds

In Billions

| | Phase1 | 1 & 2 | 1, 2 & 3 | Tier 3 | Tier 4 |
|---|---|---|---|---|---|
| Revenue Bonds – Private Activity | 1,539 | 1,539 | 1,539 | 1,539 | 1,539 |
| User Fees | 428 | 428 | 428 | 428 | 428 |
| Revenue Bonds – Metrolink | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| State Grants | 1,451 | 1,451 | 1,451 | 1,451 | 1,451 |
| TEU Bonds | 8,003 | 11,171 | 11,839 | 6,279 | 6,340 |
| Local Funding | 879 | 879 | 879 | 879 | 879 |
| **Total** | **13,300** | **16,469** | **17,136** | **11,576** | **11,638** |

# Policy Options

# Guidance Needed

1. Preferred Alternative
2. Funding Commitments

# Next Steps

- Additional Analysis
- Consensus Building
- Legislation
- Institutional Framework
- Implementation

# Freight Rail Emission Reduction Strategy To Help Meet 2014 Air Quality Standards for PM2.5

## Preliminary Proposal

SCAG Goods Movement Control Strategies Workshop - August 2, 2007